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PROGRESS

Streamside Tailings Superfund Report

By the Montana Department of Health and Environmental Sciences and the U.S. Environmental Protection Agency

INTRODUCTION

The Montana Department of Health and Environmental Sciences (MDHES) has recently completed the Draft Baseline Risk Assessment Report for the Streamside Tailings portion of the Silver Bow Creek/Butte Area Superfund site. The risk assessment identifies existing and potential risks to both human health and the environment.

The human health risk assessment uses site-specific concentrations of contaminants and assumptions about human exposure to site contaminants to determine the risk the site poses to public health. The ecological risk assessment evaluates existing and potential impacts to the environment at the site, but is generally less quantitative than the human health risk assessment. The baseline risk assessment will guide MDHES and the U.S. Environmental Protection Agency (EPA) in reaching a final decision about site cleanup.

MDHES has released the Draft Baseline Risk Assessment for public comment and will accept comments through Monday, April 10, 1995. MDHES and EPA encourage the public to read the document and submit comments. (Please refer to the "Get Involved" section of this progress report.)

GET INVOLVED

MDHES is quickly approaching a cleanup decision for the Streamside Tailings site. A feasibility study outlining cleanup alternatives and the agencies' proposed plan for site cleanup should be released this Spring. Following public review and comment on these documents, MDHES and the U.S. EPA expect to choose a remedy for the site by August 1995. MDHES encourages the public to become involved in site issues and the decision-making process. There are a variety of ways to get involved:

ROUNDTABLE MEETINGS

MDHES has been hosting regular "roundtable" meetings. These open, public meetings are held about once every month for people to voice their opinions and to discuss a variety of topics such as land use, institutional controls, the remedial investigation, feasibility study, etc. To get on the mailing list to receive meeting notices please contact Jim Ford, MDHES Site Project Officer, at 1-800-246-8198 or (406) 444-1420.

PUBLIC COMMENT

The public comment period for the Streamside Tailings Baseline Risk Assessment has been extended through Monday, April 10, 1995. Written comments and correspondence regarding the site may be sent to Jim Ford, MDHES Site Project Officer, Montana Department of Health and Environmental Sciences, P.O. Box 200901, Helena, MT 59620-0901.

LEARN ABOUT THE SITE

MDHES has established document repositories at the following locations. The repositories contain the site documents which the public is allowed to borrow for review.

Anaconda
Hearst Free Library

Bozeman
Montana State University Renne Library

Butte
Silver Bow Library
Montana Tech Library
EPA office in basement of Courthouse
CTEC office at Montana Tech

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GET INVOLVED (FROM PAGE 1)

Deer Lodge
National Park Service - Grant-Kohrs Ranch office
Deer Lodge Public Library

Helena
MDHES office at 2209 Phoenix Ave.
EPA office in the Federal Building
State Library
Montana Historical Society Library

Missoula
Missoula Public Library
University of Montana Mansfield Library
Clark Fork - Pend Oreille Coalition Office

SUPERFUND HOTLINE

MDHES operates a toll-free phone line for members of the public who have questions, comments or concerns about Superfund issues. The line is answered by MDHES Superfund staff in Helena. Please feel free to make use of the hotline. The number is 1-800-246-8198.

BACK ISSUES OF PROGRESS REPORTS

MDHES has back issues of site progress reports like this one available upon request. To obtain progress reports about other Streamside Tailings topics such as: site background, community involvement, the remedial investigation, etc. or about any other Montana Superfund site, please call MDHES at 1-800-246-8198 or (406) 444-1420 in Helena.

HOW WAS THE RISK ASSESSMENT CONDUCTED?

THE HUMAN HEALTH RISK ASSESSMENT

MDHES conducted the Streamside Tailings Baseline Risk Assessment at the same time the potentially responsible party, Atlantic Richfield Company (ARCO) conducted the Remedial Investigation. MDHES relied on technical reports, health studies, and site specific information. The human health risk assessment had four primary steps:

1) identification of *contaminants of concern (COCs)*,
2) *toxicity assessment*,
3) *exposure assessment*, and
4) *risk characterization*.

Identification of *contaminants of concern* is the process of determining which contaminants at the site should be fully evaluated in the risk assessment. MDHES conducted this screening process based upon site-specific contaminant concentrations and other information including health studies and laboratory investigations.

The *toxicity assessment* examines the potential for each contaminant of concern to cause adverse health effects and provides an estimate of the "dose-response" relationship. "Dose-response" relationship refers to the amount of contamination to which a person must be exposed before suffering adverse health effects. Adverse health effects can be either carcinogenic (cancer-causing) or non-carcinogenic (adverse health effects other than cancer) with different techniques used for evaluating each.

For carcinogens, a "cancer potency factor" is established that relates the probability of developing cancer for a given dose of a contaminant. Toxicity studies assume that any amount of exposure to a carcinogen carries some risk of developing cancer. The amount of risk associated with a given exposure to a contaminant measures the strength (or potency) of a carcinogen. The measure of a carcinogen's strength is called a "slope factor."

For non-carcinogens, a "reference dose" (RfD) is determined. Scientists believe that there is a certain dose of a noncarcinogen that the human body can tolerate without showing signs of illness. The reference dose is an estimate of the maximum quantity of a contaminant to which a person can be exposed over a long period of time and still show no adverse health effects. For example, studies indicate that too much of the metal copper can cause respiratory disorders in children. However, using toxicity studies and analytical models, EPA has estimated that an individual could eat or drink up to 2.5 milligrams of copper each day for 70 years without experiencing a respiratory disorder, even taking into account the extra sensitivity during childhood years. This amount is known as the "reference dose" (RfD) for copper. Since the exact amount of a contaminant people can tolerate depends on the specific characteristics of a contaminant, reference doses differ for various contaminants.

The exposure assessment evaluates how people may come in contact with contaminants and predicts the amounts of contaminants entering the body. At the Streamside Tailings site, potential exposure to site contaminants includes ingestion, inhalation, and/or direct contact with contaminated soil, groundwater, surface water, and/or stream sediments. MDHES used EPA guidance and some site-specific information to make assumptions about how people can be exposed to site contamination. Actual site data was used to calculate concentrations of contaminants on site to which people might be exposed.

The *exposure assessment* also considered that people use the site differently both now and in the future. Thus, different exposure estimates were made for people that might work at the site, recreate along the creek, use railroad bed trails if such a conversion is made in the future, and/or live within or adjacent to the site. By using a variety of different potential exposures, the risk assessment provides a spectrum of risk estimates that can be employed when different land uses are considered in decisions on remedial alternatives for the site.

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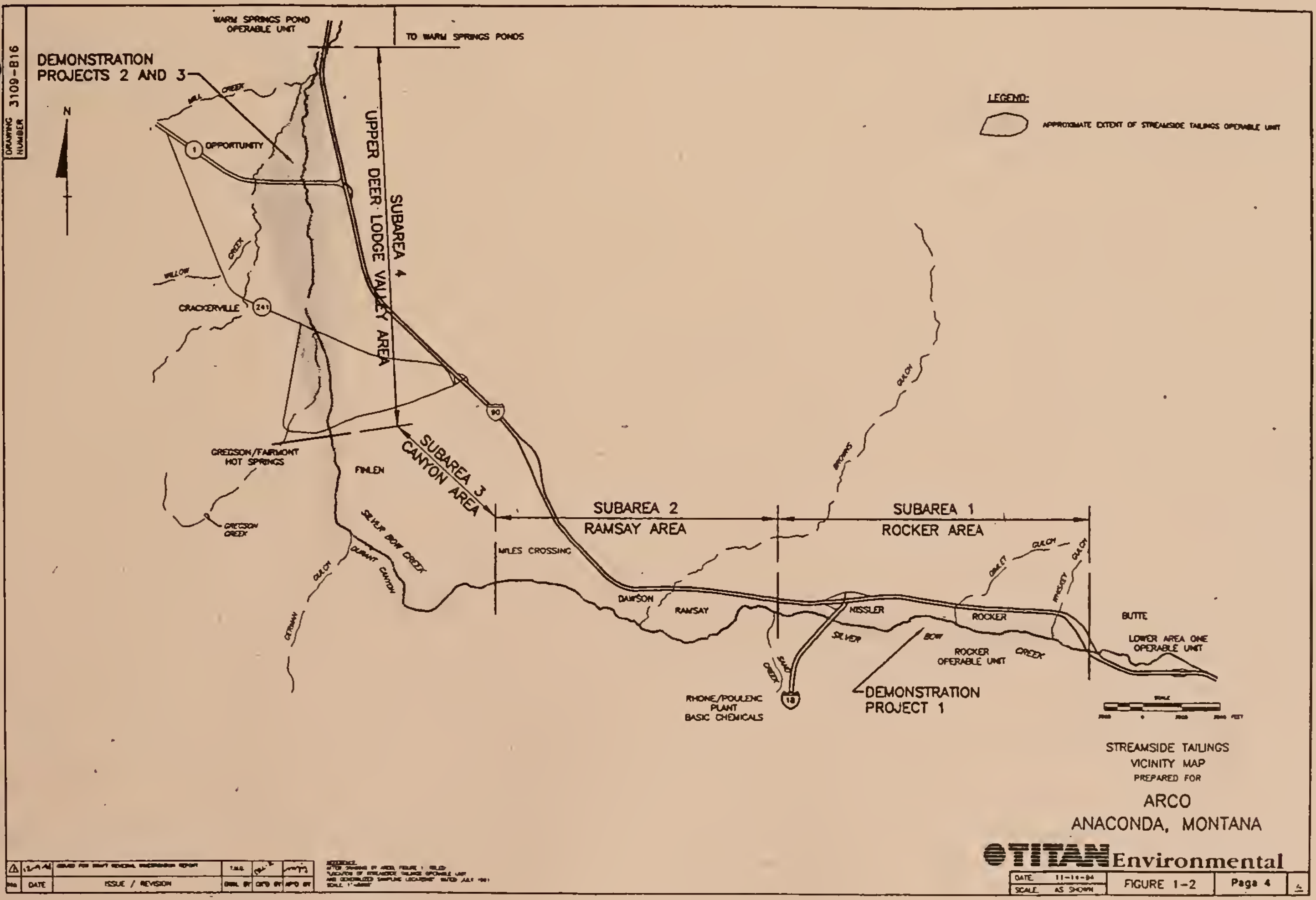
Information from the *toxicity assessment* and the exposure assessment are combined in the risk characterization to determine current and potential risks. In this final portion of the risk assessment, numerical risk values are calculated for each contaminant and each exposure pathway and for the total combined risk from multiple pathways. Later in the Superfund process, MDHES will evaluate potential site remedial alternatives and compare how well those alternatives can reduce the current and potential risks from site contamination.

WHAT IS CONSIDERED AN "ACCEPTABLE " RISK?

EPA has set a risk range from one-in-ten-thousand (1 in 10,000 or 10^{-4}) to one-in-one-million (1 in 1,000,000 or 10^{-6}) as the cleanup goal for Superfund sites. A risk of one-in-one-million means that one person out of one million could develop cancer as a result of a lifetime exposure to the site contaminants. This refers to the incremental risk that is above and beyond the probability that an individual may develop some form of cancer from other common sources.

In general, risks greater then one in 10,000 are considered unacceptable and warrant risk reduction, usually in the form of cleanup. Risks less then one in 1,000,000 are generally considered acceptable and require no cleanup action to be taken. When risks fall within the risk range, between one and 10,000 and one in 1,000,000, cleanup action may or may not be warranted depending upon on site-specific circumstances, potential cumulative effects from contaminants, and the determination of the agencies.

For noncarcinogens, risks are assessed by comparing estimated exposures with a "safe" dose defined by a reference dose (RfD) (see above). Where estimated exposures exceed RfDs, the potential for adverse noncancer effects is assumed to be present. Risks are not quantified in the same way that cancer risks are, but generally can be assumed that the greater the difference between estimated exposures and RfDs, the greater the potential for adverse effects. A hazard index of one (1) which means that estimated exposure is equal to the RfD, while an index of two (2) means that the estimated exposure is twice as large as the RfD. In general, risks exhibiting a hazard index greater then one (1) will require some form of cleanup.



THE RISK ASSESSMENT FINDINGS

HUMAN HEALTH RISK ASSESSMENT CONCLUSIONS

The Streamside Tailings Baseline Human Health Risk Assessment evaluates three exposure scenarios to determine the health risks if no action were to be taken at the site. This includes risks related to site use by residents, workers (occupational), and recreationists. Risks were divided into those which may cause cancer and those which cause adverse health effects other than cancer (non-carcinogenic risks).

POTENTIAL HUMAN HEALTH EFFECTS

Streamside Tailings contaminants may present a human health threat to exposed people. Following is a brief summary of potential health effects from the primary contaminants of concern.

Arsenic -- Ingestion of high levels of arsenic may cause digestive pain, nausea, vomiting and diarrhea. Ingestion may also lead to decreased production of red and white blood cells, abnormal heart function, blood vessel damage, liver and kidney injury, and impaired nerve function. At lower levels of exposure, ingestion may also result in skin problems, a condition known a "blackfoot" disease, and increased risk of skin, liver, bladder, kidney and lung cancers. Inhalation effects are similar to ingestion effects, especially the increased risk of lung cancer. In fact, lung disease associated with arsenic inhalation exposure was first recognized in a study of worker health at the old smelter in Anaconda. Arsenic is considered to have both carcinogenic (cancer-causing) and noncarcinogenic (those which cause adverse health effects other than cancer) effects.

Cadmium -- Breathing high levels of cadmium severely damages the lungs and can cause death. Eating food or drinking water with very high levels severely irritates the stomach, leading to vomiting and diarrhea. Long-term exposure to lower levels may result in kidney disease, lung damage and fragile bones. There is some evidence, primarily in animal studies, that breathing cadmium may cause lung cancer.

Copper -- Ingestion of excessive amounts of copper may result in adverse affects to the digestive system, kidneys and liver. Chronic over-exposure to copper may cause anemia. Ingestion of copper salts may cause salivation, digestive irritation, nausea, vomiting, gastric pain, gastritis, and diarrhea although relatively high levels of exposure are necessary to induce these effects. Eye contact with copper salts may result in conjunctivitis and corneal lesions. Copper is not known to cause cancer.

Lead -- Lead can affect many organs and systems of the body, but the most sensitive is the central nervous system, especially in young children whose bodies are still developing. Harmful effects may include premature births, reduced birth weight, decreased mental ability of infants, learning difficulties and reduced childhood growth. In adults, lead may decrease reaction time, cause weakness of fingers, wrists or ankles and possibly affect memory. Lead may also cause anemia, abortion and may damage the male reproductive system.

Mercury -- Exposure to high levels of mercury can permanently damage the brain, kidneys, and developing fetus. The nervous system is very sensitive to mercury's effects. Mental effects may include personality changes, tremors, changes in vision or hearing, and difficulties with memory.

Zinc -- As with copper, a certain amount of zinc is required in humans diets. Extremely high doses of zinc have been shown to be fatal in animal tests. At lower doses, zinc may cause digestive distress and tissue alteration, and pancreatic abnormalities. Ingestion of zinc has also been linked to anemia in humans and animals. Zinc may also cause adverse affects to the liver and kidneys. Chronic exposure to zinc must be at extremely high levels to produce adverse health effects.

Residents

To evaluate residential exposure to floodplain contaminants, MDHES considered a house located outside, but adjacent to, the 100-year floodplain with a yard leading down to Silver Bow Creek. Under this scenario, children and adults could be exposed to contaminated soils located outside and inside the floodplain and within the residential yard. Exposure to creek water and sediments was evaluated under the recreational scenario (below). The vast majority of residents in Rocker, Silver Bow, Ramsay, and Opportunity live outside the area of greatest impact from tailings and their exposure to contaminants is expected to be limited.

The primary carcinogenic risk to people living on or near the site comes entirely from potential exposure to arsenic in soil and groundwater (see Table 1). Elevated concentrations of arsenic can be found in tailings areas such as the Ramsay Flats and in shallow (less than 20 feet below ground surface), near-stream groundwater.

Noncarcinogenic risks exceeded acceptable levels for arsenic in soils under the residential scenario. As with the carcinogenic risks, the noncarcinogenic risks vary depending on the amount of contamination a person comes in contact with on site. Noncarcinogenic risks related to arsenic, cadmium, copper and zinc in groundwater were found only in shallow, near-stream groundwater within and directly adjacent to the 100-year floodplain. The risks posed by lead contamination in soil are generally within the acceptable range based on the risk model used in Butte.

Limited groundwater data demonstrate that shallow groundwater exceeds drinking water standards in some areas and also suggest that deeper site groundwater does not presently exceed drinking water standards. Most, if not all, water supply wells are located in deeper groundwater. The State of Montana presently prohibits the construction of shallow wells (less than 20 feet below the top of the water table) in floodplains.

Occupational

The "occupational scenario" evaluates the risk to workers within the site and focuses on agricultural workers in areas outside the 100-year floodplain. The risk assessment indicates that carcinogenic risk falls within an acceptable range (see Table 1). Noncarcinogenic risks to agricultural workers are mostly related to arsenic and are also generally acceptable. If workers were to equally divide their work time between areas inside and outside the floodplain their risks might be higher by a factor of three (3) and could exceed acceptable levels.

Recreationists

Both carcinogenic and noncarcinogenic risks to site visitors are posed by future use of the railroad beds (see Table 1). This could become a major concern if present plans for use of railroad beds as a trail system are developed. Risks exceed the acceptable EPA risk range. Elevated levels of arsenic where past ore concentrate spills occurred on the railroad beds create a hazard to recreational users and would therefore require cleanup. As in the residential scenario, using the Butte model, the risks posed by lead are within the acceptable range.

THE ECOLOGICAL RISK ASSESSMENT

The Ecological Risk Assessment is conducted in a manner similar to, although less specific than, the human health risk assessment. The conclusions are generally qualitative and focus on whether the environment (plant and animal life) is or may be adversely impacted.

In Silver Bow Creek, which is devoid of fish and many other aquatic life forms, the presence of mine waste contamination is the primary factor limiting the health of the aquatic environment. These contaminants affect both the water quality and streambed sediments in Silver Bow Creek and create a toxic environment for fish and most aquatic insects (benthic macroinvertebrates). Other concerns which may affect the health of Silver Bow Creek include siltation of the stream bottom, channelization, and disturbance of adjacent land and streamside (riparian) habitat.

In addition to the metals associated with mining waste, the risk assessment also evaluated the risk to the environment from pentachlorophenol (PCP) and polycyclic aromatic hydrocarbons (PAH), both of which originated from an upstream wood treating Superfund site, as well as from dissolved oxygen, ammonia, and nitrogen. The Ecological Risk Assessment evaluates potential effects of these contaminants in soil, surface water, and in-stream sediments. PCP and PAH were not considered significant contaminants in stream sediments. Ammonia, nitrogen, and dissolved oxygen are adversely impacting water quality in some areas of Silver Bow Creek which are affected by these parameters.

Soil

Many near-stream surface soil areas are critically impacted by tailings deposits and devoid of vegetation. Surface soil risk is measured in terms of the toxicity of contaminants to plants (phytotoxicity). The contaminants posing the greatest threat in surface soils include arsenic, copper, lead, and zinc (see

Table 1
Simplified Summary of Human Health Risks

Exposure Medium	Carcinogenic Risk for Exposure to:		
	Residential	Occupational	Recreationists
Soil	Unacceptable	Acceptable	Acceptable
Instream Sediment	NA[1]	NA	Acceptable
Surface Water	NA[1]	NA	Acceptable
Ground Water	Unacceptable	NA	NA
Air	Acceptable	Acceptable	Acceptable
Railroad Materials	NA[1]	NA	Unacceptable

NA - Not analyzed for this exposure scenario, [1] - See page 4-125 of Draft Baseline Risk Assessment for "Residents who Recreate" within the site.

Table 2). Moderate threats are posed by cadmium and mercury.

Surface Water

Surface water has been severely impacted throughout the length of Silver Bow Creek and serves as a contaminant pathway to sediments and the aquatic environment. In Silver Bow Creek, trout populations have been eliminated entirely, due, in part, to contaminated surface water.

Risks from surface water relate to how the contaminants may adversely affect aquatic plants, fish and other stream life. Surface water contaminants which pose the greatest risk to the health of the stream include copper and zinc (see Table 2). Zinc is a significant threat in upstream sections of Silver Bow Creek, but concentrations and potential risks decrease somewhat downstream. Cadmium, lead, mercury, and pentachlorophenol are considered moderate threats. Ammonia, nitrogen, and to a lesser extent, low dissolved oxygen are other limiting factors in certain reaches of Silver Bow Creek.

Sediment

Contaminated sediments in Silver Bow Creek act as a critical contaminant pathway to impacted surface water and aquatic life, particularly aquatic insects (benthic macroinvertebrates).

Contaminants in sediment posing a high risk to the environment are arsenic, cadmium, copper, lead, mercury, and zinc (see Table 2). Mercury is a contaminant which concentrates in plant and animal tissue (bioaccumulation) and can potentially move up in the food chain (biomagnification). Mercury poses a small current threat because there are no fish in the creek. However, fish and other biota exposed to the levels of mercury currently in the creek sediment could be at risk.

Table 2
Simplified Summary of Ecological Risks to Silver Bow Creek

Contaminant	Soils	Surface Water	Instream Sediments
Contaminants Throughout Creek			
Arsenic	High	Low	High
Cadmium	Moderate	Moderate	High
Copper	High	High	High
Lead	High	Moderate	High
Mercury	Low to Mod.	Low to Mod.	High
Zinc	High	High	High
Contaminants in Limited Reaches of Creek			
Polycyclic Aromatic Hydrocarbons	Unknown/ Probably low	Low	Low
Pentachlorophenol	Unknown/ Probably low	Moderate	Low
Ammonia	-----	Mod. to High[1]	-----
Dissolved Oxygen	-----	Low to High[1]	-----
Nitrogen	-----	Mod. to High[1]	-----

[1] - Location/timing dependent, See Baseline Risk Assessment, Executive Summary Table, ES - 10

ARE YOU ON OUR MAILING LIST?

If you wish your name to be added to or deleted from the mailing list for Streamside Tailings, or if you wish to update your address, please fill out, detach, and mail the following form to Jim Ford, Montana Department of Health and Environmental Sciences, P.O. Box 200901, Helena, MT 59620-0901.

Name ______________________________

Address ______________________________

City, State ______________________________

Zip ______________

If you receive this progress report by mail, there is no need to complete this form, unless you wish to have your name removed from the list or have your address changed. If so, please check below.

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SEND US YOUR COMMENTS!

The comment period on the Streamside Tailings Baseline Risk Assessment Report ends

MONDAY, APRIL 10, 1995

Send your comments to:

Jim Ford, MDHES Site Project Officer
P.O. Box 200901
Helena, Montana 59620-0901

* * *

Superfund Program
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